EXPERIMENTS ON THE VIBRATION OF AIR IN CONICAL HORNS

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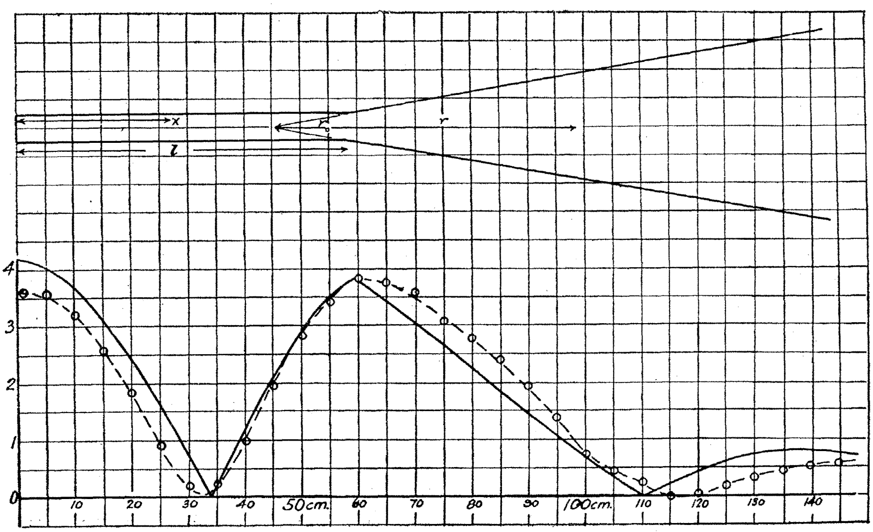
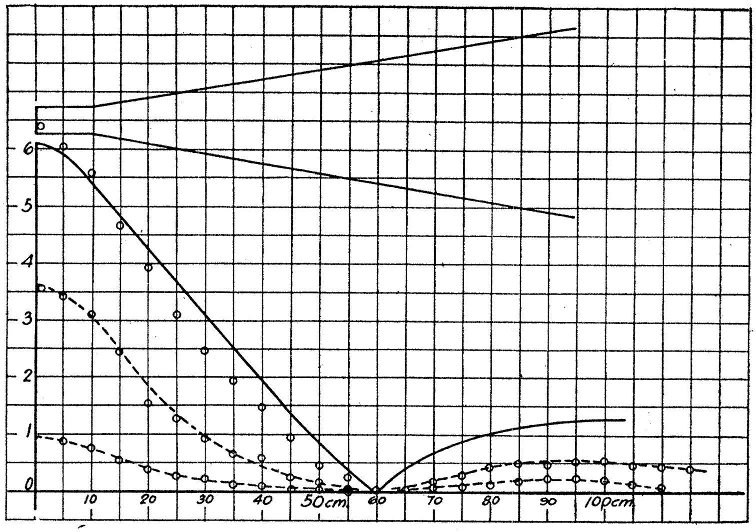
At the meeting of the Committee on Sound of the National Research Council recently held at Geneva, Illinois, it was represented to me that my habit of not publishing results had been a serious detriment to the progress of certain investigators in sound and I was strenuously urged to reform my habits. I shall, therefore, take the liberty of bringing out of my drawers a certain number of papers some of which I have had for many years but which for one reason or another have not been published.

The curves presented herewith were shown at a meeting of the American Association for the Advancement of Science in Columbus in 1915,



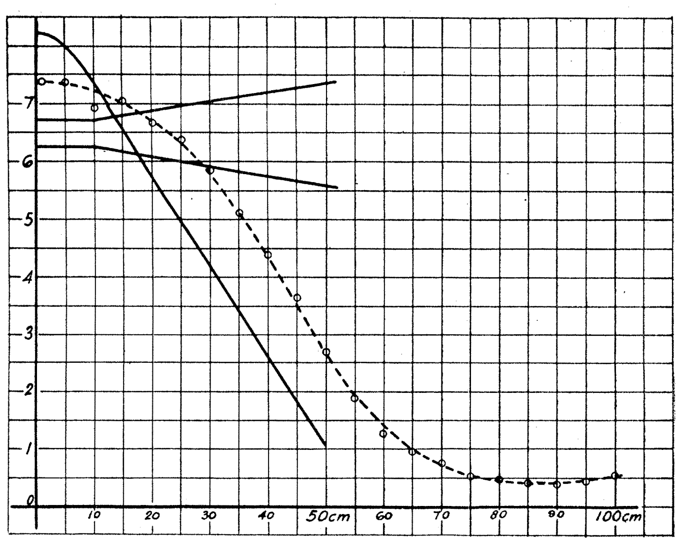
but I believe have not been published. They were made by means of the phonometer and phone described in my paper in these PROCEEDINGS. **5**, May, 1919 (163–166), and they are intended to verify the theory of horns given by me in these PROCEEDINGS, **5**, July, 1919 (275–283).

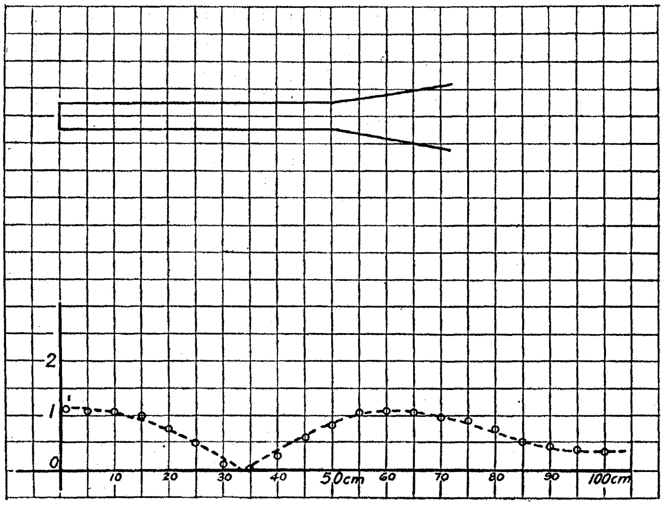
The horn is always a portion of a circular cone mounted on one end of a cylindrical tube, the other end of which is closed. The sound was made by the phone emitting a constant sound of a pitch of 256 per second. The standing waves inside the horn were explored by an antenna consisting of a glass tube of three millimeters internal diameter and several feet long attached to a disk closing the end of a cylindrical tube screwed into the opening of the phonometer. This could be put into any part of



the space to be explored. To be sure, the pressure measured by the phonometer is not the same as that of the antenna, but inasmuch as standing waves are formed in the antenna the pressure measured by the phonometer is proportional to that at the end of the antenna and, therefore, to that in the place to be observed.

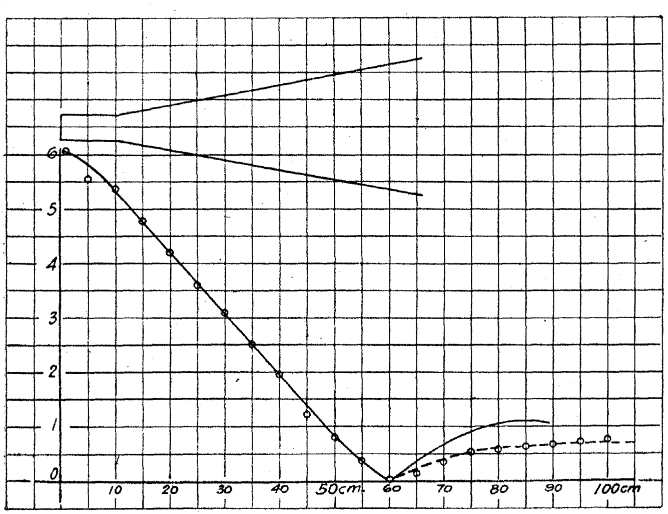
The figures printed herewith show on the dotted lines the actual observations and on the full lines the theory. The shape and dimensions of the

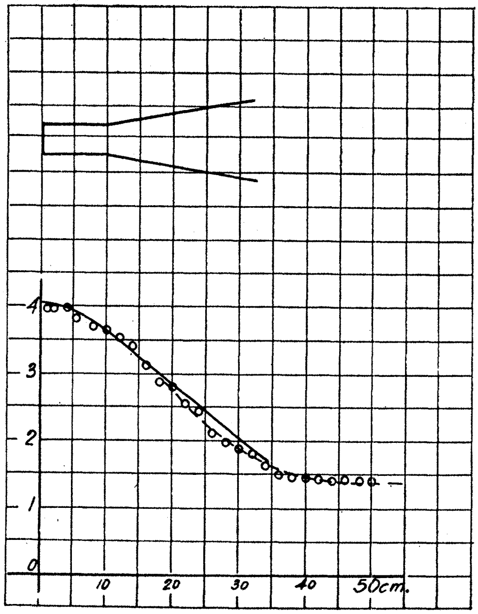




horns are also shown on the figures. The experiments were made by my then assistant, Dr. H. F. Stimson, to whom I am indebted for his careful work.

It will be seen that the theory is very substantially verified, the defect in it being due to the very rough estimate made about the correction of the open end which, as I stated in my paper on horns, is far from being accurate. But inasmuch as it is the only theory that has ever been given I feel that the results constitute a distinct advance. Prof. G. E. Stewart has done a large amount of work on horns and he also confirms my theory

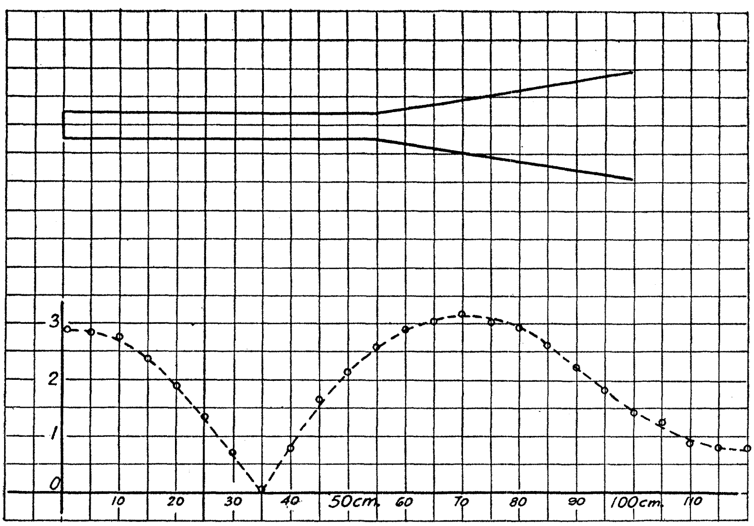




with about the same degree of accuracy as it was confirmed by these results more than four years ago. Professor Stewart has also given a theoretical treatment that is an improvement on mine. We shall see whether it agrees better with the observations. The formulae I have used in calculating these curves are:

In cylinder $$p = \frac{P \sin \beta \cos kx}{r_0 \cos kl},$$

In cone $$p = P \sin k(r - r_0 + \beta)/r,$$



$$P = p_o r_o/\sin\beta, \quad \tan k\beta = 1/(\operatorname{ctn} k\alpha - \tan kl), \quad \tan k\alpha = kr_o.$$

I enclose the following errata in my article on horns cited above:

PAGE	EQUATION	FOR	READ
276	4	$\frac{k}{2V}i$	$\frac{k}{2\pi}i$
277	13	uv	uv
278	17	$uv,\ \alpha v$	$uv,\ \alpha v$
278	19–20	d	∂
281	above 36	$Z_1 = ck^2\{$	$Z_1 = ek^2\{$
281	after 37	$H.K.$	$H.F.$
282		$\frac{d^2p}{vn^2} + m\frac{dp}{vn} + p = 0,$	$\frac{\partial^2 p}{\partial x^2} - m\frac{\partial p}{\partial x} + k^2 a = 0$
		$p = e^{-\sqrt{4-k^2x}}\lvert A\cos kx + B\sin kx\rvert$	$p = e^{\frac{mx}{2}}\{A\cos k\sqrt{1-(m/2k)^2}.x + B\sin k\sqrt{1-(m/2k)^2}.x\}$
		$x = e^{-\sqrt{4-k^22}}\lvert C\cos kn + Dmk^2\rvert$	$X = e^{\frac{mx}{2}}\{C\cos k\sqrt{1-(m/2k)^2}.x + D\sin k\sqrt{1-(m/2k)^2}.x\}$

THE RELATIVE IMPORTANCE OF HEREDITY AND ENVIRONMENT IN DETERMINING THE PIEBALD PATTERN OF GUINEA-PIGS

By Sewall Wright

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The Bureau of Animal Industry has been carrying on an experiment on the effects of inbreeding on guinea-pigs since 1906. Twenty-three families were started successfully from as many pairs and were maintained wholly by matings of brother with sister. Another stock from the same source has been maintained as a control, without mating even second cousins.

A number of color variations were present in the original stock and most of them kept appearing during the early history of each family as the result of Mendelian segregation. After a number of generations, however, a certain color became fixed automatically within each inbred line. In some cases an entire family came to produce only one color. In most cases, the families became broken into a number of sub-families, each characterized by a particular color.

The original stock consisted largely of tricolors. Conspicuous differences in the average amounts of white and yellow appeared among the inbred families from the first, proving the existence of hereditary differences in pattern. Contrary, however, to the case of the qualitative differences in color, no types of pattern ever became at all well fixed. Varia-